CLAIMS

What is claimed is:

1. An apparatus for regulating the flow of a gas between a high-pressure zone and a zone of lower pressure, said apparatus comprising:

a hollow body having an axis;

a first chamber and a second chamber, said chambers defined within said body;

a nozzle within said body and separating said chambers, said nozzle defining a passage for the passage of gas between said chambers; and

a stem movable axially within said passage and comprising:

a distal portion extending at least partially into said first chamber;

a proximate portion within said second chamber and extending into said passage, wherein axial movement of said stem varies the position of said proximate portion in relation to said nozzle; and

an o-ring seat between said proximate portion and said distal portion of said stem and contactable with said nozzle to seal said passage against the passage of gas.

2. An apparatus according to claim 1 wherein a convexly curved wall defines said nozzle.

3. An apparatus according to claim 2 wherein said curved wall is defined by a long radius arc and the nozzle comprises a minimum diameter.

4. An apparatus according to claim 3 wherein the ratio of said long radius to said nozzle minimum diameter is between approximately 2.53:1 and approximately 2.27:1.

5. An apparatus according to claim 1 wherein said distal portion is removably connectable to said proximate portion of said stem, and further wherein when connected, said distal portion and said proximate portion define an annular pocket for receiving said o-ring seat.

6. An apparatus according to claim 5 wherein said distal portion and said proximate portion have a screwed engagement, and wherein when fully engaged said distal portion and said proximate portion squeeze said seat and capture said seat within said pocket.

7. An apparatus according to claim 6 wherein less than one third of the toroidal circumference of said seat is exposed outside the confines of said pocket.

8. An apparatus according to claim 6 wherein said o-ring seat comprises an axial cross-sectional area, and said pocket defines an axial cross sectional area from about 7% to about 10% larger than said cross-sectional area of said seat, wherein when said seat is squeezed in said pocket a void is defined in said pocket between said seat and said stem.

9. An apparatus according to claim 1 further comprising:

an axially directed guide hole defined between said body and said proximate portion of said stem; and

a guide pin inserted in said guide hole thereby to prevent rotation of said proximate portion around said axis.

10. An apparatus according to claim 3 wherein a diameter of said proximate portion of said stem is at least 98% of said nozzle minimum diameter.

11. An apparatus according to claim 10 further comprising means defined in said proximate portion for providing gas flow area between said stem and said nozzle.

12. An apparatus according to claim 11 wherein said means for providing gas flow area comprises stem flow grooves defined in said stem.

13. An apparatus according to claim 1 wherein said body defines an opening in its top, and said stem is removable from said body through said opening.

14. An apparatus according to claim 1 wherein said seat comprises a polymer selected from the group consisting of PTFE Teflon® polymer, CTFE Neoflon® polymer, and Viton® polymer.

15. An apparatus according to claim 1 further comprising a seal disposed at said

16. An apparatus according to claim 1, wherein the said proximate portion of said stem comprises a threaded means for separably attaching said stem to an adjustment handle, said threaded means comprising barrel means for containing thread wear debris.

17. An apparatus according to claim 16, wherein said proximate portion of said stem defines an external groove for mating with a non-rotational guide pin.

18. An apparatus according to claim 17, wherein said hollow body defines, adjacent said proximate stem portion, an internal groove for mating with a non-rotational guide pin.

19. An apparatus according to claim 18 further comprising a guide pin which insertable through a top of said body for mating with said stem external groove and said body internal groove throughout the axial stroke of said stem.

20. An apparatus according to claim 8 further comprising a vent hole defined in said stem for providing fluid communication between said pocket and said second chamber for balancing pressures between said pocket and said second chamber.

21. An apparatus according to claim 15, wherein said distal portion and said proximate portion are screwably connectable.

22. An apparatus according to claim 15 further comprising:

a spring flange movably disposed within said body;

a disk member positionally fixed within said body, said spring flange and said disk member defining there-between an interstage chamber; and

an axially symmetric shaft passing through a portal in said fixed disk and through said interstage chamber to separably connect said spring flange to said stem.

23. An apparatus according to claim 22 further comprising an internal seal for precluding fluid flow past said disk member.

24. An apparatus according to claim 23 further comprising a gasket seal on said the distal side of said fixed disk for precluding fluid flow radially past said distal side.

25. An apparatus according to claim 24 further comprising a piston conduit defined in said body for conveying pressure from said first chamber to a proximate end of said proximate stem portion.

26. An apparatus according to claim 25 further comprising a balancing conduit defined in said body for conveying the fluid pressure from said second chamber and past said disk member to said interstage chamber.

27. An apparatus according to claim 26 further comprising a snap ring means, engageable with a circumferential grove in said body, for holding said disk member in position.

28. An apparatus according to claim 27 wherein said spring flange is separably connected to a proximate end of said axially symmetric shaft, thereby fixably connecting said spring flange to said stem.

29. An apparatus according to claim 28 further comprising a threaded barrel member defining a central portal in its bottom and an axial extension from said spring flange, wherein said extension of said spring flange passes through said portal, and said extension is free to slide within the portal.

30. An apparatus according to claim 29 further comprising a spring or flexible biasing means disposed axially between said barrel and a proximal side of said spring flange, the compression of said biasing means of further comprising a means for selectively adjusting the force balance on the spring flange for regulating pressure in said second chamber.

31. An apparatus for regulating the flow of a gas between a high-pressure zone and a zone of lower pressure, said apparatus comprising:

a hollow body having an axis;

a first chamber and a second chamber defined within said body;

a nozzle within said body and separating said chambers, said nozzle defining a passage for the passage of gas between said chambers; and

a stem movable axially within said passage and comprising:

a distal portion extending at least partially into said first chamber;

a proximate portion at least partially within said second chamber and extending into said passage, wherein axial movement of said stem varies the position of said proximate portion in relation to said nozzle; and

an o-ring seat between said proximate portion and said distal portion of said stem and contactable with said nozzle to seal said passage against the passage of gas.

32. An apparatus according to claim 31 wherein a convexly curved wall defines said nozzle.

33. An apparatus according to claim 34 wherein said curved wall is defined by a long radius arc and the nozzle comprises a minimum diameter.

34. An apparatus according to claim 33 wherein the ratio of said long radius to said nozzle minimum diameter is between approximately 2.66:1 and approximately 2.17:1.

35. An apparatus according to claim 34 wherein said distal portion is removably connectable to said proximate portion of said stem, and further wherein when

connected, said distal portion and said proximate portion define an annular pocket for receiving said o-ring seat.

36. An apparatus according to claim 35 wherein said distal portion and said proximate portion have a screwed engagement, and wherein when fully engaged said distal portion and said proximate portion squeeze said seat and capture said seat within said pocket.

37. An apparatus according to claim 36 wherein less than one third of the toroidal circumference of said seat is exposed outside the confines of said pocket.

38. An apparatus for regulating the flow of a gas between a high-pressure zone and a zone of lower pressure, said apparatus comprising:

a hollow body having an axis;

a first chamber and a second chamber defined within said body;

a nozzle within said body and separating said chambers, said nozzle defining a passage for the passage of gas between said chambers; and

a two-piece stem movable axially within said passage and comprising:

a distal portion extending at least partially into said first chamber;

a proximate portion at least partially within said second chamber and extending into said passage, wherein said distal portion is separably connected to said proximate portion; and

an o-ring seat disposed between said proximate portion and said distal portion of said stem and contactable with said nozzle to seal said passage against the passage of gas;

wherein axial movement of said stem varies the position of said proximate portion in relation to said nozzle.

39. An apparatus according to claim 38 further comprising:

an axially directed guide hole defined between said body and said proximate portion of said stem; and

a guide pin inserted in said guide hole thereby to prevent rotation of said proximate portion around said axis.

40. An apparatus according to claim 38 wherein said distal portion of said stem and said proximate portion of said stem define a pocket there-between for receiving and capturing said o-ring seat.